IN THE CLAIMS

1. (Currently amended) A two-dimensional code reading apparatus for reading from an input image a two-dimensional code which is representative of various items of information by arranging in two-dimensional form~~, such as in a horizontal and vertical directions,~~ data cells, each recording binary data thereon, said two-dimensional code comprising finder patterns, each having a specific first pattern, which are disposed in a plurality of predetermined positions within said two-dimensional code for identifying the position of said two-dimensional code within said input image, and an alignment pattern which is disposed in a predetermined position different from those of the finder patterns within said two-dimensional code, said alignment pattern having a second pattern which is different from the first pattern specific to said ~~finder pattern~~ finder patterns, wherein processing for detecting the positions of said plurality of finder patterns which are disposed in the plurality of predetermined positions from said input image is conducted based upon a result of scanning of said input image in a plurality of directions; processing for detecting the position of said alignment pattern is conducted based upon the detected finder patterns; processing for determining a version of said two-dimensional code which defines the number of cells constituting said two-dimensional code is conducted based upon said detected finder patterns; processing for cutting out the data cells which define the data value of each of the data cells constituting

said two-dimensional code is conducted based upon the positions of said detected finder patterns and said alignment pattern and said version which is determined by said version determining process; and processing for decoding to identify the information of said two-dimensional code is conducted in accordance with a predetermined rule from the data values of the data cells which are determined by said data cell cutting out processing.

2. (Currently amended) The two-dimensional code reading apparatus as defined in Claim 1, wherein:

a plurality of candidates of the finder patterns having a pattern which is approximate to said finder patterns including black and white specific first patterns are extracted from said input image as candidate finder patterns;

a constitutional ratio of the black and white patterns along a scanning line across each candidate finder pattern in three directions~~, such as horizontal, vertical and inclined,~~ is detected for each of said plurality of extracted candidate finder patterns;

the detected constitutional ratio of the black and white pattern in each direction is compared with that of said specific first pattern including black and white patterns which is predetermined as said finder pattern to calculate an evaluation value representative of an approximation between the candidate pattern and said first pattern~~,~~; and

a predetermined number of said candidate finder patterns are selected from among said extracted plurality of candidate finder patterns in order from the candidate finder pattern having greater proximity which is represented by said evaluation value, so that respective positions of the predetermined number of selected finder patterns are detected.

3. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 2, wherein if said evaluation value representative of the approximation between said candidate finder pattern and said first pattern specific to said finder pattern in any of horizontal, vertical and inclined directions of said extracted plurality of candidate finder patterns is calculated as a value exceeding a predetermined threshold so that the candidate pattern is not approximate to said first pattern, said candidate finder pattern is excluded from among the candidates of said finder patterns.

4. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 3, wherein said threshold can be preliminarily preset to a desired value by a user depending upon type and application of said two-dimensional code and quality of input image.

5. (Currently amended) The two-dimensional code reading apparatus as defined in Claim 2, wherein if said extracted candidate finder patterns are ~~extracted which are disposed positioned so as to be~~

superposed ~~in proximity are extracted~~, said superposed candidate finder patterns ~~which are in superposing positions~~ are unified, and said evaluation values of respective candidate finder patterns prior to unification are summed so that the sum is represented as the evaluation value of the unified candidate finder patterns.

6. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 2, wherein if the difference between a width representative of the size of said extracted candidate finder patterns and a predetermined specific width representative of the size of said finder pattern in any of the horizontal, vertical and inclined directions exceeds a predetermined acceptable value, said candidate finder pattern is excluded from among the candidates of said finder patterns.

7. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 6, wherein said acceptable value can be preliminarily set to a desired value by a user depending upon type and application of said two-dimensional code and quality of input image.

8. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 2, wherein an average of the widths of said finder pattern in three directions, such as horizontal, vertical and inclined, is used as the width representative of the size of the detected finder pattern.

9. (Previously presented) The two-dimensional code reading apparatus as defined Claim 1, wherein a cell size representative of the dimensions of the cells constituting said two-dimensional code is determined based upon a width representative of the size of the detected finder pattern.

10. (Previously presented) The two-dimensional code reading apparatus as defined Claim 1, wherein the version of said two-dimensional code is determined by calculating the number of cells which constitutes said two-dimensional code based upon the spacing between said detected plurality of finder patterns and the cell size representative of the dimensions of the cells derived from the width representative of the size of said finder pattern.

11. (Currently amended) The two-dimensional code reading apparatus as defined in Claim 10, wherein said apparatus comprises a version registration table showing the correspondence between the version of the two-dimensional code and the number of the registered cell constituting the two-dimensional code which is determined by the version and that said version registration table is retrieved based upon the calculated number of cells, whereby the number of said registered cells having matched or approximate value and the version corresponding to said number of registered cells is determined as the number of cells which constitute the two-dimensional code and ~~its~~ the version of said two-dimensional code, respectively.

12. (Currently amended) The two-dimensional code reading apparatus as defined in Claim 1, wherein a determination whether or not the orientation of the two-dimensional code is angularly rotated in the input image is made based upon respective coordinates of the detected plurality of finder patterns and ~~in that if it is determined that it~~ if the orientation of the two-dimensional code is rotated, then the rotational angle of the two-dimensional code is calculated.

13. (Previously presented) The two-dimensional code reading apparatus as defined Claim 1, wherein the presence of the inclination of each side of said two-dimensional code in the input image is detected by detecting the presence of the inclination of said finder patterns in said input image, in that a retrieval reference point with reference to which the range of the retrieval for retrieving said alignment pattern in said input image is designated is determined from the inclination of each side and the coordinates of the centers of said finder patterns, and in that partial image in the retrieval range which is located in predetermined position from the determined retrieval reference point is cut out from said input image and in that the position of said alignment pattern is detected by extracting said alignment pattern comprising said second pattern from said part of the image.

14. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 13, wherein the presence of the

inclination of said finder pattern is detected by detecting the coordinates of at least two pixels among the coordinates of the pixels which form part of the side of said two-dimensional code on which said finder pattern is located and form the outer contour of said finder pattern by scanning the pixels of said finder pattern.

15. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 13, wherein a point of intersection of a straight line passing through the coordinates of the center of said finder pattern forming part of the side of said two-dimensional code and parallel with said side of said two-dimensional code and a straight line passing through the coordinates of the center of the other finder pattern which is diagonally opposite to said finder pattern within said two-dimensional code and forms part of the other side of said two-dimensional code and is parallel with said other side is determined as said retrieval reference point, with reference to which said retrieval range for retrieving said alignment pattern is specified.

16. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 13, wherein said retrieval range is an area which is so wide to include said second pattern specific to said alignment pattern with a margin of at least two-cell size from an estimated central coordinates at which the location of center of said

alignment pattern is estimated as being remote from said retrieval reference point by a predetermined distance.

17. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 13, wherein there is provided a template which matches a feature of each pixel which said second pattern specific to said alignment pattern and in that said alignment pattern comprising said second pattern is extracted from said partial image by conducting template matching between said template and said partial image while shifting by one pixel.

18. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 17, wherein if the orientation of said two-dimensional code is angularly rotated in said input image, partial image within said retrieval range which is specified by applying the coordinates of said retrieval reference point to the rotational correction based upon the angle at which said orientation of said two-dimensional code is rotated is cut out from said input image and in that after applying the rotation correction for the cut out partial image based upon said rotational angle, the position of said alignment pattern is detected by conducting said template matching while shifting said rotation corrected partial image by one pixel for extracting said alignment pattern.

19. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 17, wherein said partial image which is

to be processed for said template matching is the partial image which is cut out from said input image which is under a condition prior to binary processing.

20. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 19, wherein when processing for said template matching is conducted, the sum of the absolute values of difference between the pixel value of the pixels of said template and the pixel value of corresponding pixels of said partial image is calculated while sequentially shifting said partial image by one pixel, whereby the position within said partial image in which the sum of absolute values becomes a minimum is determined as the coordinates of said alignment pattern.

21. (Previously presented) The two-dimensional code reading apparatus as defined in any of Claim 1, wherein when processing for cutting out said data cells to determine the data value of each data cell which forms said two-dimensional code is conducted, conversion coefficients of coordinate conversion expressions for converting the position of the center of each data cell of said two-dimensional code into the coordinates in said input image based upon the cell positions of the centers of said finder patterns and said alignment pattern, which are detected by a position identifying process of said data cell and based upon the number of cells of said two-dimensional code which is determined by the identified version, in that the center position

of each data cell is converted into the coordinates of said input image by using said coordinate conversion expressions to which the calculated conversion coefficients are applied for identifying the coordinates corresponding to the center position of each data cell, and in that a data value of each data cell is determined based upon the density of the coordinate position which is identified by said position identifying process for conducting cutting out of each data cell.

22. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 21, wherein when a process for cutting out said data cells to determine the data value of each data cell which forms said two-dimensional code, the density of said input image at coordinates corresponding to the position of the center of the data cell which is identified by said position identifying process is the density which is obtained from the pixel value of the pixel existing at said coordinates if a pixel exists at the coordinates in said input image corresponding to the position of the center of the identified data cell and it is the density which is obtained by interpolation of pixel values of peripheral pixels adjacent to said coordinates if a pixel does not exist at the coordinates in said input image corresponding to the position of the center of the identified data cell, and in that the data value of each data cell is determined by comparing said density of the input image at the coordinates

corresponding to the position of the center of each data cell with a light and dark threshold for identifying the data value of each data cell.

23. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 22, wherein said light and dark threshold for identifying the data value of each data cell is set based upon the pixel values of the pixels in said input image which are located along the diagonal of said two-dimensional code.

24. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 23, wherein said light and dark threshold is set to an intermediate value between the maximum and minimum of pixel values of all pixels in said input image which are located along the diagonal of said two-dimensional code.

25. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 1, wherein if cutting out of said data cells is not properly conducted so that reading of said two-dimensional code fails, a process for cutting out said data cells is repeated again after changing by one version which is determined by said version determining step.

26. (Previously presented) A portable terminal which is built in a camera comprising the two-dimensional code reading apparatus as defined in Claim 1.

27. (Previously presented) A digital camera comprising the two-dimensional code reading apparatus as defined in Claim 1.

28. (Currently amended) A two-dimensional code reading process for reading from an input image a two-dimensional code which is representative of various items of information by arranging in two-dimensional form~~, such as in a horizontal and vertical directions,~~ data cells, each recording binary data thereon, said two-dimensional code comprising finder patterns, each having a specific first pattern, which are disposed in a plurality of predetermined positions within said two-dimensional code for identifying the position of said two-dimensional code within said input image, and an alignment pattern which is disposed in a predetermined position different from those of the finder patterns within said two-dimensional code, said alignment pattern having a second pattern which is different from the first pattern specific to said finder patterns, wherein processing for detecting the positions of said plurality of finder patterns which are disposed in the plurality of predetermined positions from said input image is conducted based upon a result of scanning of said input image in a plurality of directions; processing for detecting the position of said alignment pattern is conducted based upon the detected said finder patterns; processing for determining a version of said two-dimensional code which defines the number of ~~cell~~ cells constituting said two-dimensional code is conducted based upon said detected finder

patterns; processing for cutting out the data cells which define a data value of each of the data cells constituting said two-dimensional code is conducted based upon the positions of said detected finder patterns and said alignment pattern and said version which is determined by said version determining process; and processing for decoding to identify the information of said two-dimensional code is conducted in accordance with a predetermined rule from the data values of the data cells which are determined by said data cell cutting out processing.

29. (Currently amended) The two-dimensional code reading process as defined in Claim 28, wherein a plurality of candidates of the finder patterns having a pattern which is approximate to said finder patterns comprising said black and white specific first patterns are extracted from said input image as candidate finder patterns, in that the constitutional ratio of the black and white patterns along a scanning line across each candidate finder pattern in three directions ~~such as horizontal, vertical and inclined directions~~ is detected for each of said plurality of extracted candidate finder patterns, in that the detected constitutional ratio of the black and white pattern in each direction is compared with that of said specific first pattern comprising black and white patterns which is predetermined as said finder pattern to calculate an evaluation value representative of the approximation between the candidate pattern and said first pattern,

and in that a predetermined number of said candidate finder patterns are selected from among said extracted plurality of candidate finder patterns in order from the candidate finder pattern having higher proximity which is represented by said evaluation value, so that respective positions of the predetermined number of selected finder patterns are detected.

30. (Previously presented) The two-dimensional code reading process as defined in Claim 28, wherein the version of said two-dimensional code is determined by calculating the number of cells which constitute said two-dimensional code based upon the spacing between said detected plurality of finder patterns and the cell size representative of the dimensions of the cells derived from the width representative of the size of said finder pattern.

31. (Previously presented) The two-dimensional code reading process as defined in Claim 28, wherein the presence of the inclination of each side of said two-dimensional code in the input image is detected by detecting the presence of the inclination of said finder patterns in said input image, in that a retrieval reference point with reference to which the range of the retrieval for retrieving said alignment pattern in said input image is designated is determined from the inclination of each side and the coordinates of the centers of said finder patterns, and in that partial image in the retrieval range which is located in predetermined position from the

determined retrieval reference point is cut out from said input image and in that the position of said alignment pattern is detected by extracting said alignment pattern comprising said second pattern from said part of the image.

32. (Previously presented) The two-dimensional code reading process as defined in Claim 31, wherein there is provided a template which matches a feature of each pixel which said second pattern specific to said alignment pattern and in that said alignment pattern comprising said second pattern is extracted from said partial image by conducting template matching between said template and said partial image while shifting by one pixel.

33. (Previously presented) The two-dimensional code reading process as defined in Claim 32, wherein if the orientation of said two-dimensional code is angularly rotated in said input image, partial image within said retrieval range which is specified by applying the coordinates of said retrieval reference point to the rotational correction based upon the angle at which said orientation of said two-dimensional code is rotated is cut out from said input image and in that after applying the rotation correction for the cut out partial image based upon said rotational angle, the position of said alignment pattern is detected by conducting said template matching while shifting said rotation corrected partial image by one pixel for extracting said alignment pattern.

34. (Previously presented) The two-dimensional code reading process as defined in Claim 32, wherein said partial image which is to be processed for said template matching is the partial image which is cut out from said input image which is under a condition prior to binarization processing.

35. (Previously presented) The two-dimensional code reading process as defined in Claim 28, wherein when processing is conducted for cutting out said data cells to determine the data value of each data cell which forms said two-dimensional code, conversion coefficients of coordinate conversion expressions for converting the position of the center of each data cell of said two-dimensional code into the coordinates in said input image based upon the cell positions of the centers of said finder patterns and said alignment pattern, which are detected at a step of identifying the position of said data cell and based upon the number of cells of said two-dimensional code which is determined by the identified version, wherein the center position of each data cell is converted into the coordinates of said input image by using said coordinate conversion expressions to which the calculated conversion coefficients are applied for identifying the coordinates corresponding to the position of the center of each data cell, and wherein a data value of each data cell is determined based upon the density of the coordinate position which is identified by

said position identifying process for conducting cutting out of each data cell.

36. (Previously presented) The two-dimensional code reading process as defined in Claim 35, wherein when a process for cutting out said data cells to determine the data value of each data cell which forms said two-dimensional code, the density of said input image at coordinates corresponding to the position of the center of the data cell which is identified by said position identifying process is the density which is obtained from the pixel value of the pixel existing at said coordinates if a pixel exists at the coordinates in said input image corresponding to the position of the center of the identified data cell and it is the density which is obtained by interpolation of pixel values of peripheral pixels adjacent to said coordinates if a pixel does not exist at the coordinates in said input image corresponding to the position of the center of the identified data cell, and wherein the data value of each data cell is determined by comparing said density of the input image at the coordinates corresponding to the position of the center of each data cell with a light and dark threshold for identifying the data value of each data cell.

37. (Previously presented) The two-dimensional code reading process as defined in Claim 36, wherein said light and dark threshold for identifying the data value of each data cell is set based upon the

pixel values of the pixels in said input image which are located along the diagonal of said two-dimensional code.

38. (Previously presented) A program for reading two-dimensional code which is described in program code and which is capable of causing a computer to execute a process of reading the two-dimensional code as defined in Claim 28.

39. (Original) A recording medium which is readable by a computer and on which the two-dimensional code reading program as defined in Claim 38 is recorded.

40. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 3, wherein said threshold can be preliminarily preset to a desired value by a user depending upon type and application of said two-dimensional code or quality of input image.

41. (Previously presented) The two-dimensional code reading apparatus as defined in Claim 6, wherein said acceptable value can be preliminarily set to a desired value by a user depending upon the type and application of said two-dimensional code or quality of input image.